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A Concept for Improving the Dimensional Stability of Filamentary Composites in One Direction

An analytical investigation was conducted into the design of filamentary composites having high strength and stiffness and a zero thermal coefficient of expansion in one direction. Advanced filament materials, such as boron, used in three-dimensional reinforcement configurations demonstrated substantial advantages over conventional filamentary composites.

Calculated strength, stiffness, and density of selected composites designed to give zero thermal coefficients of expansion in one direction compared favorably with such structurally efficient materials as the better titanium alloys. An analysis of three-dimensional reinforcement configurations revealed a capability for substantially enhanced strength properties, particularly for loadings where shearing stresses inclined at angles to the filaments are critical. Calculated stiffness properties of the three-dimensional reinforcement configurations are also generally superior to those of planar, two-dimensional reinforcements.

A major contribution of this study is the quantitative demonstration of enhanced shear strengths provided by three-dimensional reinforcement at angles to the filaments. The fact that the quantitative increases have been calculated to be so substantial should provide impetus to the development of such three-dimensionally reinforced composites.

Guidelines were established for the characteristics of the filamentary material, binder, and reinforcement configuration required to achieve a filamentary composite with a zero thermal coefficient of expansion in one of its principal directions. Analysis methods were developed for the evaluation of the elastic constants, the thermal expansion coefficients, and the strengths of two- and three-dimensionally reinforced composites.

Note:

The following documentation may be obtained from:

National Technical Information Service
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.95)

Reference:
NASA-CR-1324, (N69-24876), Zero Thermal Expansion Composites of High Strength and Stiffness

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

Patent Counsel
Mail Code 173
Langley Research Center
Langley Station
Hampton, Virginia 23365

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